

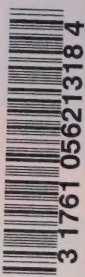
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SOCIO ECONOMIC PROFILE OF THE
CANADIAN GREAT LAKES BASIN

By
Anne Sudar
Water Planning and Management
December 1982

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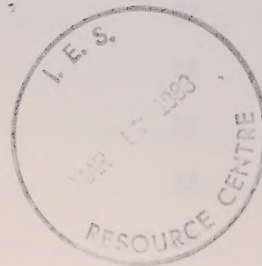
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PREFACE

In less than two hundred years, the Great Lakes Basin has changed from a forest ecosystem which included small groups of Indians whose impact on the Basin was very insignificant to the industrial heartland of North America, a much more complex type of ecosystem in which people and their activities are the major agents of change. This transformation is the subject of much of the following report, and the accompanying socio-economic benefits to the present inhabitants of the region are many-fold. However, this development of an industrial society has had two major side-effects. The first is resource depletion, a below-surface, hinterland phenomena which is relatively inconspicuous to most of the residents of the basin. The second major side-effect is pollution, a surface phenomena which is much easier for people to see. Feedback from both of these effects is beginning to reach Great Lakes Basin society in the forms of higher prices for energy, food and other necessities as well as warnings not to eat certain Lake Ontario fish. The socio-economic framework of the Basin is rapidly changing, and at this point the outcome is very uncertain, but there are many indications that past trends will be reversed or stabilized leading to a better balance and harmony between the socio-economic system and the natural ecosystem.

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Introduction

The major focus of this report will be the social and economic activities of the people living in the Canadian portion of the Great Lakes Basin. Approximately 86 percent of the population of Ontario and 92 percent of the province's economic activity is located in the drainage basin of the Great Lakes.

Whenever possible, statistics have been converted to a watershed basis, but some data which could not be broken down applies to Ontario as a whole. Most of the social and economic trends which can be observed in Ontario and the Great Lakes Basin are not unique to this area, but are found throughout North America.

Some of the statistics may seem outdated, but they represent the most recent available figures at the time this report was written (mid 1981).

An updated and expanded version is planned for 1983.

Population

The number of people living in the Canadian portion of the Great Lakes Basin has grown from 70,000 in 1765 to 7,500,000 in 1981. This represents a 100-fold increase in a little over 200 years.

A population pyramid for the Canadian Great Lakes Basin is shown in Figure 1. It breaks the 1976 population down by sex and age group. The most striking characteristic of this pyramid is the bulge in the 10-35 year age group (the 1981 Census will likely show a bulge in the 15-39 age group). This represents the post-war baby boom generation (44% of the total basin population or 3.1 million people) which now has generally moved out of the educational system and into the job market. The relative age of the population will increase gradually over the next 20 years as this group works its way up the pyramid.

The water quality in each of the Great Lakes is generally correlated with the population density of their watersheds. As can be seen in Figure 2, it ranges from less than 2 persons per square kilometre north of Lake Superior to over 11,000 persons per square kilometre in Toronto. It is not mere coincidence that Lake Superior has the purest water and the fewest people while Lakes Erie and Ontario have the most degraded water and the most people.

The overall density in the Canadian portion of the basin was 32 persons per square kilometre in 1981. As shown in Figure 3 population density has risen steadily since European settlement of the basin.

Another perspective on the settlement pattern in the basin is presented in Figure 4, an isodemographic map of the Canadian Great Lakes Basin. The areas of the map are made proportional to the size of the population, so the scale is in people rather than space. Toronto clearly dominates the picture, and southern Ontario overshadows the rest of the basin.

However, there is another way to measure people which yields a more accurate reflection of human impact and use of the earth. This measure of population takes into consideration not only sheer numbers of people, but their energy lifestyles as well. Vallentyne (1978) has called it a demophoric unit. The word demophoric comes from 'demos', meaning population, and 'phora', meaning production. All of the people living in the Great Lakes Basin today interact with the environment in two distinct ways. First, as biological organisms, they live and grow by means of their internal metabolisms, consuming approximately 2300 kilocalories of food per day. Humans have this type of metabolism in common with all other biological beings. The distinguishing feature of humans is their larger brainpower which enables them to develop an external metabolism based on tools. These external metabolisms are not the same everywhere; they vary according to the type of technology and culture present in each society. In the industrialized society of the Great Lakes Basin, this external metabolism is highly advanced and runs primarily on fossil fuels. To quote Vallentyne (1978):

"The population has changed from a technologically low-gearred, dispersed population based on small-scale agriculture and dependent on the sun, wheels, domesticated animals, oil lamps and sails to a technologically high-gearred urbanized population with oil, electric lights, telephones, radios, cars, jogging suits, colour TV sets, super highways, supermarkets, nuclear power and jet planes. On an energy basis, the population has changed from a species with a ratio of technological energy consumption to biological energy consumption of less than 2 to nearly 100. The consequences of this in terms of total resource consumption within the basin (U.S. and Canadian parts), including the effect of increased human population over the past 170 years, are as 1 to 10,000."

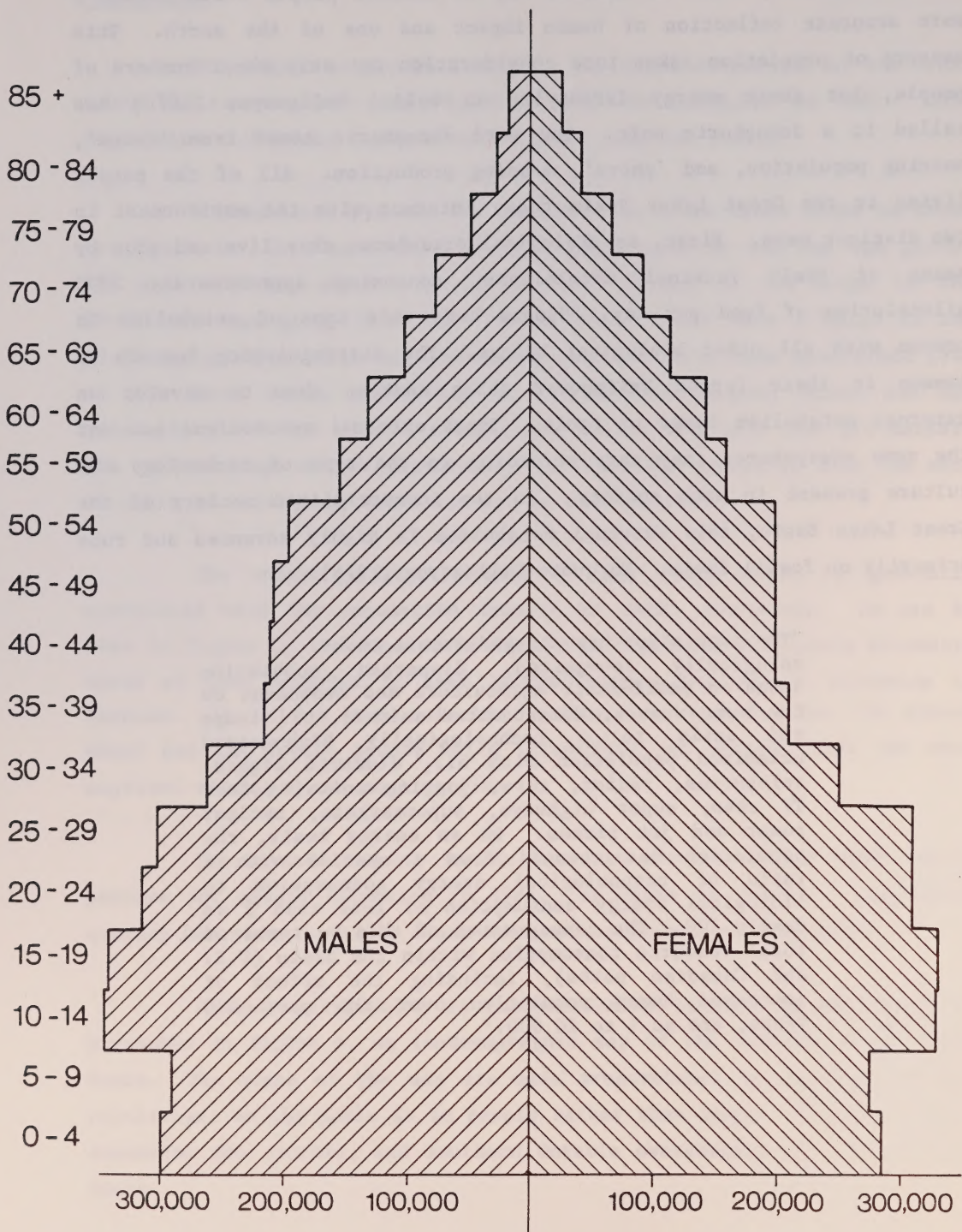


FIGURE 1. GREAT LAKES BASIN POPULATION PYRAMID 1976

SOURCE : ONTARIO MINISTRY OF TREASURY, ECONOMICS AND INTER-GOVERNMENTAL AFFAIRS, CENTRAL STATISTICAL SERVICES.



FIGURE 2. CANADIAN GREAT LAKES BASIN POPULATION DENSITY

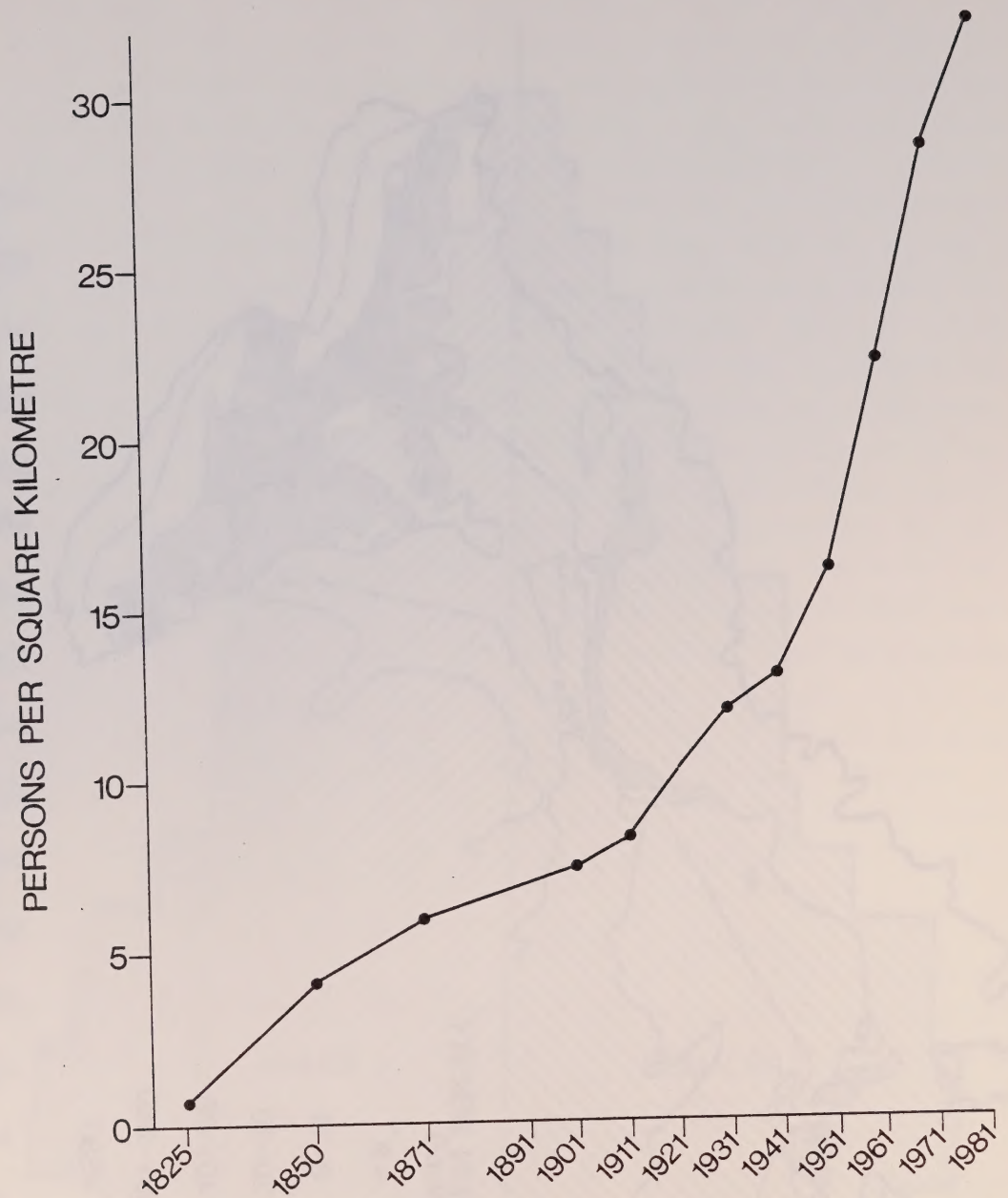


Figure 3 Population Density in the Canadian Portion of the Great Lakes Basin, 1825 - 1981

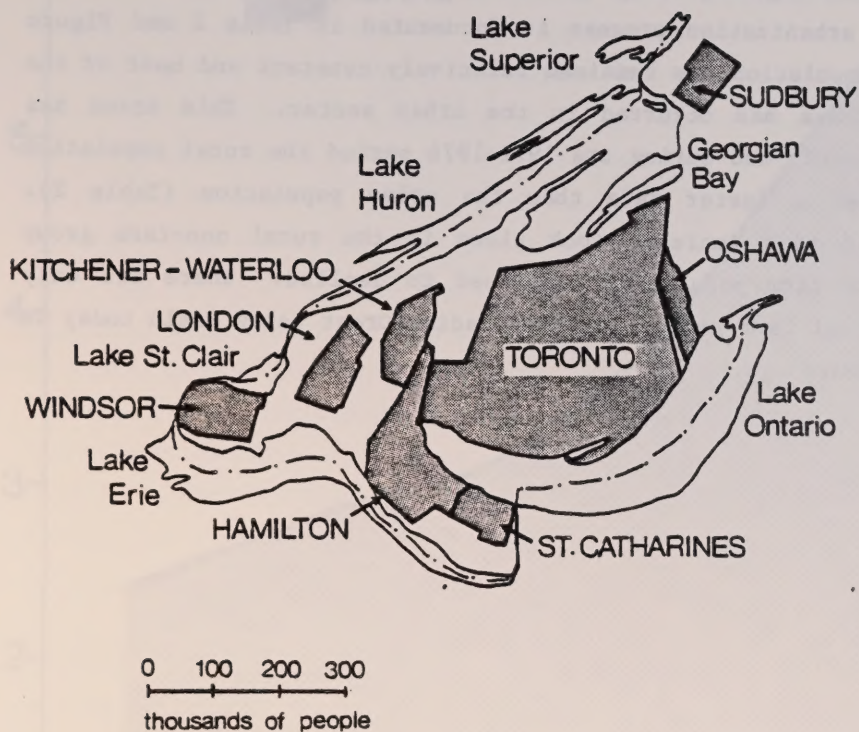


FIGURE 4: ISODEMOGRAPHIC MAP OF CANADIAN GREAT LAKES BASIN.
source : 1966 census data.

The population distribution in the Canadian Great Lakes Basin has changed from 86% rural in 1851 to 83% urban in 1976. Urbanization was made possible by two major technological developments. The first was the introduction of public water supply and sewage disposal systems which removed the health hazards associated with high population densities. The second was the use of fossil fuel-powered transportation systems which allowed the majority of people to live far away from their source of food. This urbanization process is documented in Table 1 and Figure 5. The rural population has remained relatively constant and most of the population increase has occurred in the urban sector. This trend has slowed down recently and during the 1971-1976 period the rural population actually grew at a faster rate than the urban population (Table 2). However, all of this increase took place in the rural non-farm group while the rural farm population continued to decline. There are only half as many rural farm people in the Canadian Great Lakes Basin today as there were 30 years ago.

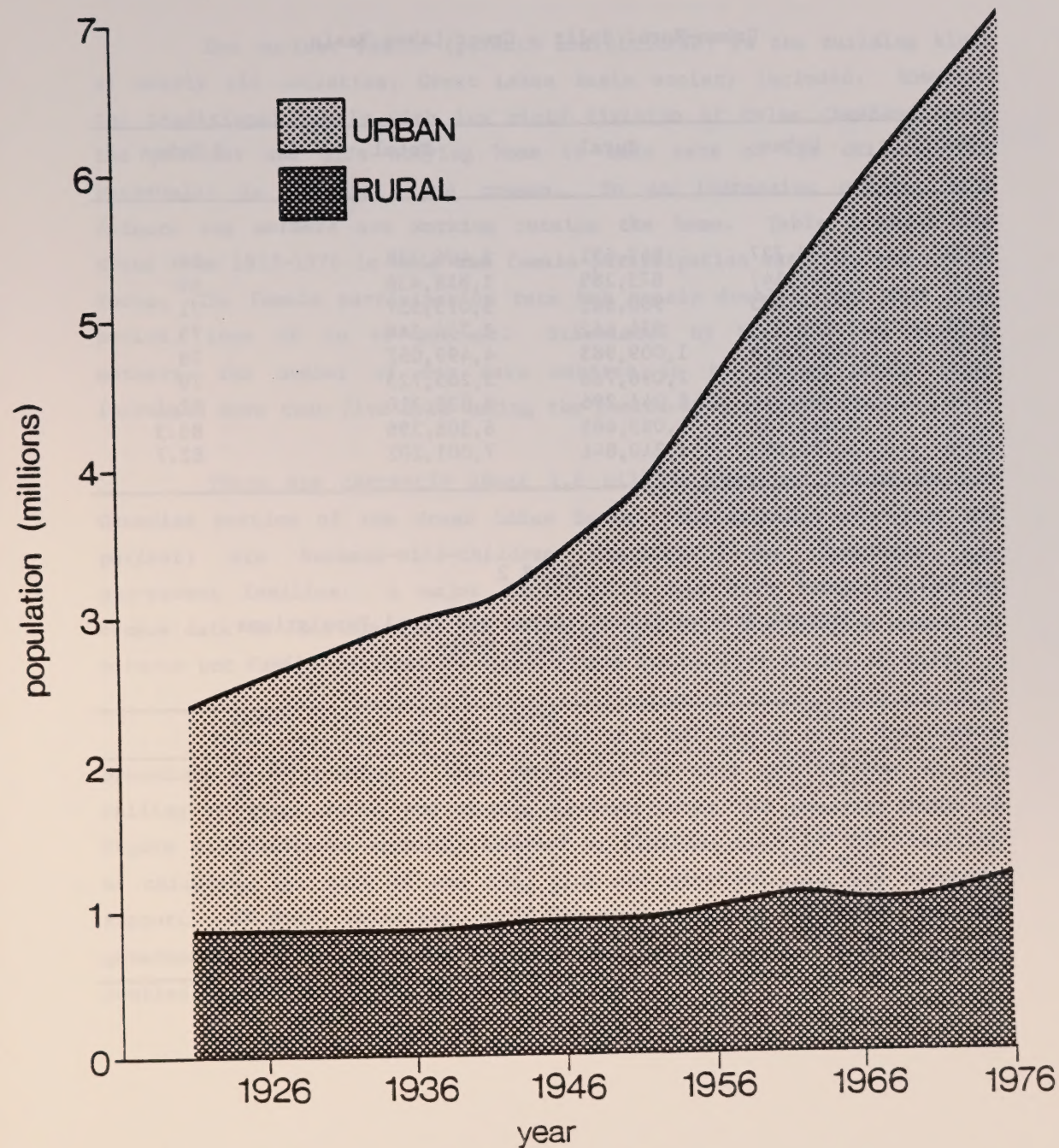


FIGURE 5. URBAN - RURAL SPLIT, GREAT LAKES BASIN
POPULATION 1921-1976

TABLE 1

Urban-Rural Split - Great Lakes Basin

Year	Urban	Rural	Total	% Urban
1921	1,530,727	867,631	2,406,358	64
1931	1,945,147	873,289	2,818,436	69
1941	2,174,695	900,862	3,075,557	71
1951	2,859,918	934,442	3,794,360	75
1956	3,489,074	1,009,983	4,499,057	78
1961	4,108,960	1,096,763	5,205,723	79
1966	4,792,014	1,041,296	5,833,310	82.1
1971	5,422,731	1,083,665	6,506,396	83.3
1976	5,790,361	1,210,841	7,001,202	82.7

TABLE 2

Annual Rate of Change, Urban and Rural Populations
Great Lakes Basin

Year	Urban	Rural
1921-1931	+2.4%	+0.1%
1931-1941	+1.1%	+0.3%
1941-1951	+2.8%	+0.4%
1951-1956	+4.1%	+1.6%
1956-1961	+3.3%	+1.7%
1961-1966	+3.1%	-1.0%
1966-1971	+2.5%	+0.8%
1971-1976	+1.3%	+2.2%

Families and Households

The nuclear family (parents and children) is the building block of nearly all societies, Great Lakes Basin society included. However, the traditional family with its rigid division of roles (husband being the provider and wife staying home to take care of the children and household) is becoming less common. To an increasing extent, both fathers and mothers are working outside the home. Table 3 shows the trend from 1953-1976 in male and female participation rates in the labour force. The female participation rate has nearly doubled over this time period, from 26 to 49 percent. Stimulated by the rise in working mothers, the number of day care centres in the Great Lakes Basin increased more than five fold during the period 1950 to 1974 (Table 4).

There are currently about 1.8 million families living in the Canadian portion of the Great Lakes Basin. The majority of these (92 percent) are husband-wife-children families. The remainder are one-parent families. A major trend which has been substantiated by census data is that families are becoming smaller. The average number of persons per family declined in Ontario from 3.6 in 1971 to 3.4 in 1976.

Fewer families are being formed on a per capita basis and family breakdown is increasing. Some indication of this can be seen in the falling marriage rates and rising divorce rates for Ontario shown in Figure 6. Functions formerly assumed by families such as the education of children, the care of the old, sick and disabled, and the economic support of poor relatives are increasingly being shifted to the government. Social services expenditures per capita in Ontario nearly doubled between 1971 and 1976 (see Figure 6).

TABLE 3

Labour Force Participation Rates
by Sex in Ontario, 1953-1976

Year	(Percent)		Total
	Male	Female	
1953	85.2	25.9	55.2
1954	85.2	27.1	55.9
1955	84.5	27.5	55.7
1956	85.0	29.4	56.9
1957	84.8	30.1	57.2
1958	84.3	29.1	56.4
1959	83.6	29.6	56.2
1960	83.2	31.4	57.0
1961	82.1	31.9	56.7
1962	81.4	31.9	56.3
1963	81.2	32.5	56.5
1964	80.6	34.0	57.0
1965	80.0	34.1	56.7
1966	79.7	35.2	57.2
1967	79.4	36.3	57.6
1968	79.2	36.9	57.7
1969	78.8	37.8	58.0
1970	78.5	38.1	58.0
1971	77.8	39.3	58.3
1972	78.3	40.3	59.1
1973	78.4	41.6	59.7
1974	78.8	43.0	60.7
1975	80.5	48.4	64.2
1976	79.6	48.9	64.0

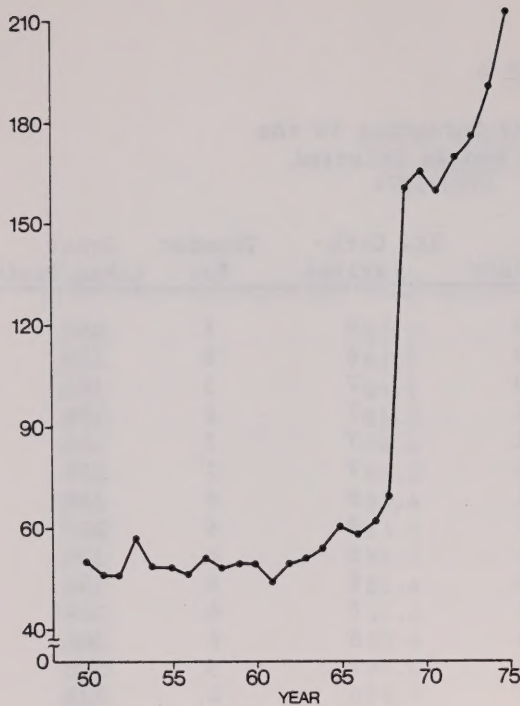
Source: Statistics Canada, Historical Labour Force Statistics.

TABLE 4

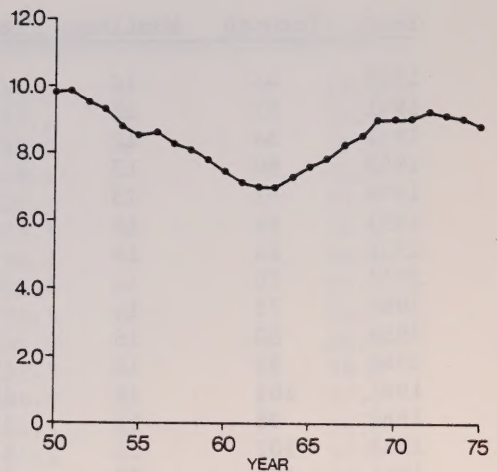
Number of Licensed Day Nurseries in the
Great Lakes Basin and in Selected
Urban Areas 1950-1974

Year	Toronto	Hamilton	London	Windsor	St. Cath- arines	Thunder Bay	Great Lakes Basin
1950	44	10	5	9	6	1	163
1951	52	12	6	10	6	3	178
1952	54	12	6	10	7	5	186
1953	60	13	6	11	7	4	196
1954	62	13	6	11	7	7	196
1955	64	12	6	11	7	7	209
1956	64	14	8	11	8	6	213
1957	70	14	8	11	8	6	212
1958	72	14	9	11	9	6	232
1959	80	16	9	16	9	6	254
1960	82	16	9	16	8	6	264
1961	101	18	10	16	8	6	306
1962	98	20	11	16	9	5	310
1963	102	24	11	16	10	4	323
1964	108	23	12	12	12	4	328
1965	113	23	12	12	12	5	348
1966	122	28	14	13	12	9	401
1967	131	28	16	14	12	11	470
1968	164	31	17	15	14	10	476
1969	172	32	21	18	14	10	626
1970	181	40	22	18	15	10	633
1971	183	40	26	19	15	10	697
1972	189	41	29	19	15	11	724
1973	202	50	32	20	16	11	828
1974	218	57	35	20	17	11	944

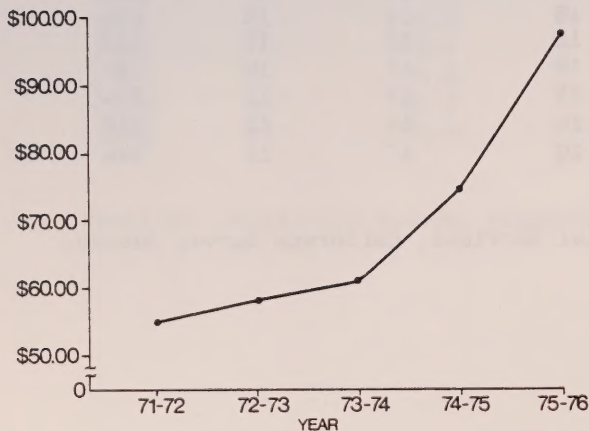
Source: Ministry of Community and Social Services, Childrens Survey Bureau.



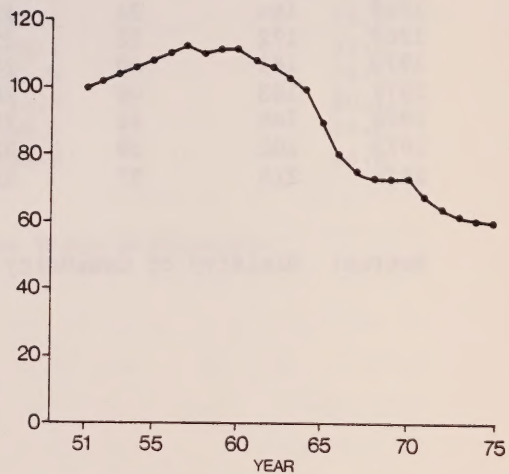
Divorce rate, Ontario 1950 - 1975,
rate per 100,000 population.
Source: Statistics Canada, Vital Statistics



Marriage rate, Ontario 1950 - 1975,
rate per 1000 population.
Source: Statistics Canada, Vital Statistics.



Social services expenditure,
per capita Ontario.
Source: Ontario Ministry of Community and Social Services



Birth rate, Ontario 1951 - 1975,
rate per 1000 women age 15-49.
Source: Statistics Canada, Vital Statistics.

FIGURE 6 SELECTED ONTARIO SOCIAL STATISTICS

A household is defined by Statistics Canada as a person or group of persons occupying one dwelling. A household may or may not be a family. The trend from 1951 to 1971 has been a significant decrease in the proportion of family households and a corresponding increase in the proportion of non-family households. The proportions of family and one-person households in the Great Lakes Basin are shown in Table 5. In urban areas 81 percent of the households were families while on farms, 92 percent were families.

There are currently about 2,255,000 households in the Canadian portion of the Great Lakes Basin. Together, they generate over 30,000 tonnes of solid waste every day (see Table 6).

Table 7 shows that households in the Great Lakes Basin are quite well equipped in terms of conveniences and labour-saving devices. Flush toilets, electric refrigerators, telephones and television sets are standard with over 97 percent of the households having them. The urban industrial system has enabled people in the Great Lakes Basin to achieve a very high material standard of living.

Trends in the proportion of households owning certain types of equipment are shown in Table 8 for the period 1967-1976. In that 9 year period, ownership of color televisions increased from less than 3 percent to 62 percent. The percentage of households owning freezers, clothes dryers, air conditioners, dish washers, and 2 or more cars has also increased significantly.

Table 5

Proportions of Family and One-person Households in the
Canadian Great Lakes Basin, 1971

	Percentage of family households	Percentage of one-person households
urban	81	14
rural	87	10
non-farm	85	12
farm	92	5

Source: Statistics Canada.

Table 6

Solid Waste Disposal Sites in the Canadian Great Lakes Basin

Lake	No. of Active Sites	Area (ha)	Volume (t/d)	No. Closed Sites	Area (ha)
Superior	97	516	554	2	10
Huron	460	3,532	6,075	26	44
Erie	158	1,944	6,520	17	113
Ontario	303	2,885	17,200	58	198
Total Great Lakes	1,016	8,877	30,349	103	365

Acres = Hectares (ha) x 2.471

Source: PLUARG, 1978.

TABLE 7

Household Facilities and Equipment in the

Canadian Great Lakes Basin, 1976

Item	Number in Basin	Percentage of House Holds Having Item
Flush Toilets	2,992,000	99
Electric Refrigerators	2,244,000	99
Home Freezers	999,000	44
Electric Washers	1,622,000	72
Clothes Dryers	1,176,000	52
Air Conditioners	546,000	24
Automatic Dishwashers	407,000	18
Telephones (in households)	3,020,000	97
Television sets	3,076,000	97
Snowblowers	181,000	8
Power Lawnmowers	1,221,000	54
Automobiles	2,500,000	81
Overnight Camping Equipment	496,000	22
Boats	361,000	16
Vacation Homes	158,000	7
Snowmobiles	203,000	9

Source: Statistics Canada, Household Facilities and Equipment.

TABLE 8

Trends in Household Equipment in Ontario 1967-1976

Year	Percentage of Households Owning:							
	Color TV's	Home Freezers	Washing Machines	Clothes Dryers	Air Cond.	Dish Washers	One Car	2 or more Cars
1967	2.7	27.4	82.8	39.6	5.1	4.0	61.9	17.8
1968	5.4	28.9	80.9	41.2	5.2	5.2	62.9	18.5
1969	9.9	31.6	80.7	45.0	6.9	6.8	62.0	18.8
1970	14.1	32.7	80.7	46.4	7.3	7.1	61.1	20.0
1971	20.4	34.2	77.5	44.9	8.9	8.6	60.0	20.6
1972	26.4	34.8	74.3	46.6	9.7	8.4	59.2	21.0
1973	35.9	36.8	72.7	47.1	11.4	10.5	57.4	23.1
1974	46.4	38.8	73.0	47.0	17.1	11.7	56.3	24.0
1975	54.9	40.4	71.3	49.2	20.8	13.5	55.5	24.7
1976	62.2	44.3	71.9	52.2	24.2	18.0	54.9	26.0

Source: SC Household Facilities and Equipment

Personal expenditure on consumer goods and services (in constant dollars) more than doubled from 1951 to 1975 according to Statistics Canada figures. Table 9 shows in general how Canadians spend their income. The proportions of income spent on food, clothing, medical care, and personal goods and services are declining, while the relative amounts spent on rent, fuel and power, transportation, and recreation are increasing.

Table 10 shows trends in home ownership and type of dwelling in Ontario from 1967-1976. Home ownership declined from 69.1 percent to 65.6 percent. The proportion of single detached houses also declined from 67.8 percent to 59.7 percent while the proportion of single attached dwellings and apartments increased.

TABLE 9

Canadian Personal Expenditure Breakdown - 1975

	%	TREND
Food, Beverages, Tobacco	19.9	down
Clothing and Footwear	8.9	down
Gross Rent, Fuel and Power	17.7	up
Medical Care and Health Services	3.1	down
Transp. and Communications	15.3	up
Recreation, Entertainment Education and Cultural Services	10.6	up
Furniture, Furnishings Household Equipment	10.4	same
Personal Goods and Services	13.3	down

Source: Statistics Canada

TABLE 10

Trends in Tenure and Type of Dwelling Ontario 1967-1976

Year	Tenure		Type of Dwelling		
	% Owned	% Rented	% Single Detached	% Single Attached	% Apartment
1967	69.1	30.9	67.8	9.2	23.1
1968	68.5	31.5	66.9	9.0	24.1
1969	68.3	31.7	66.1	9.4	24.4
1970	67.8	32.2	67.0	8.3	24.8
1971	67.2	32.8	66.2	9.1	24.7
1972	65.7	34.3	64.6	8.9	26.4
1973	65.2	34.8	62.5	9.1	28.5
1974	65.5	34.5	62.1	9.9	28.0
1975	63.7	36.3	59.6	10.0	30.4
1976	65.6	34.4	59.7	11.0	29.3

Source: SC, Household Facilities and Equipment.

Water Use

One of the most obvious impacts of people on the Great Lakes is their use of water. Most human uses of water alter in some way the quantity, quality, temporal and/or spatial pattern of water available for subsequent uses.

Several systems have been suggested for the classification of human water uses (Sewell 1968). One separates them into withdrawal uses and on-site uses. The major withdrawal uses are municipal, industrial power and irrigation. These uses are easy to measure quantitatively. The amounts of water withdrawn in the Canadian Great Lakes Basin for various purposes are listed in Table 11. In its need for cooling waters, power generation alone uses 50% of all the water withdrawn. Manufacturing uses another 40% in various types of processing. Perhaps the most important use from a human perspective is for drinking and other domestic purposes. In 1975, 512.7 million gallons per day were withdrawn for municipal and rural residential use (Tate 1979). Most of this water (77%) is taken directly from the Great Lakes, while the remainder comes either from tributary streams or groundwater. In 1976, 4.7 million Canadians used the Great Lakes as a source of drinking water (see Table 12).

Withdrawal uses can be divided into consumptive and nonconsumptive categories. Consumptive use of water is that fraction of the water intake or diversion that is not returned to the water body. Irrigation is a highly consumptive use because two-thirds of the water applied to the crop is evaporated directly into the air or transpired through plant leaves. Table 13 lists the quantities of water that are used consumptively in the Canadian Great Lakes Basin (Tate 1979). The breakdown here is different than the withdrawal uses of Table 11 because not all of the water withdrawn is consumed. The proportion consumed varies with the use. In terms of consumptive use, the largest water user is manufacturing which accounts for 34%. Municipal uses are second at 21%, followed by irrigation (15%), stock watering (14%), power (8%), rural residential (7%) and mining (1%).

TABLE 11

Water Withdrawals in the
Canadian Great Lakes Basin, 1975

(MGD)

	Lake Superior	Lake Huron	Lake Erie	Lake Ontario	Great Lakes
Municipal	17.6	56.9	93.0	308.1	475.6
Rural Resident.	0.7	12.4	13.1	10.9	37.1
Manufacturing	375.9	594.4	818.2	1071.0	2859.5
Mining	5.9	60.3	3.3	1.0	70.5
Power	21.0	529.0	543.0	2459.0	3552.0
Irrigation	1.0	11.0	39.0	21.0	72.0
Stock-watering	1.0	18.0	16.0	11.0	46.0
Total Withdrawals	423.1	1281.0	1525.6	3882.0	7112.7

Source: (Tate 1979)

TABLE 12

Canadians Drinking Great Lakes Water, 1976

Lake Superior	114,700
Lake Huron (including St. Marys R.)	521,800
Lake Erie (including Lake St. Clair, St. Clair R. and Detroit River)	431,900
Lake Ontario (including Niagara R.)	3,644,200
	<u>4,712,600</u>

Sources: Statistics Canada, 1976 Census of Canada Catalogue 92-806
(Bulletin 1.7) and Ontario Ministry of the Environment 1979
Water and Wastewater Treatment Works in Ontario.

TABLE 13

Water Consumption in the Canadian Great Lakes Basin - 1975

(MGD)

	Lake Superior	Lake Huron	Lake Erie	Lake Ontario	Great Lakes
Municipal	2.6	8.5	14.0	46.2	71.3
Rural					
Residential	0.4	7.4	7.9	6.5	22.2
Manufacturing	10.2	31.6	33.1	39.4	114.3
Mining	0.5	1.2	0.5	0.0	2.2
Power	0.0	4.0	4.0	19.0	27.0
Irrigation	1.0	9.0	24.0	17.0	51.0
Stock- Watering	1.0	18.0	16.0	11.0	46.0
Total Consumption	15.7	79.7	99.5	139.1	334.0

Source: Tate, 1979.

The people of the Great Lakes basin also use the lakes for waste disposal. About 4.2 million Canadians discharge their sewage into the Great Lakes (Table 14). Most of this sewage receives secondary treatment and phosphorus removal before it reaches the lakes, but it still has an effect on water quality, particularly in nearshore areas.

Along with the deliberate use of water for waste disposal, there is inadvertent use of water for waste disposal. This occurs when air pollutants fall directly into the Great Lakes and other surface water. The Great Lakes Science Advisory Board, in its 1980 Annual Report to the International Joint Commission, stated that the atmospheric inputs of toxic metals such as zinc and lead are likely the most significant source of these contaminants to the Lake Superior and Huron Basins. Another way in which human activities affect water is the leaching of pollutants from landfill sites into surrounding groundwater and eventually into the Great Lakes. Examples of this are the Love Canal and Hyde Park chemical waste dumps in the Niagara Falls area.

Non-withdrawal uses include flow uses and on-site uses. Flow uses depend on the flow of water through a designated channel. Such uses include the generation of hydro-electric power, navigation, waste dilution, and certain types of water-based recreation such as viewing Niagara Falls. The Canadian portion of the Great Lakes system has an installed hydroelectric capacity of 3,122 180 kilowatts (International Lake Erie Regulation Study, 1981). In 1980, the power generated by Great Lakes water represented 19% of all the electricity produced by Ontario Hydro. (Roy Walker, Ontario Hydro).

TABLE 14

Canadians Discharging Their Sewage Into The Great Lakes - 1976
(via Sewage Treatment Plants)

Lake Superior	114,500
Lake Huron (Including St. Marys River)	163,100
Lake Erie (Including Lake St. Clair, St. Clair R. and Detroit River.	303,300
Lake Ontario (Including Niagara River)	<u>3,578,100</u>
	4,159,000

Sources: Ontario Ministry of the Environment 1979.
Water and Wastewater Treatment Works in Ontario.

Statistics Canada, 1976 Census of Canada,
Catalogue No. 92-806 (Bulletin 1.7)

On-site uses include the many forms of water-oriented recreation, from swimming to viewing the shoreline. Sport fishing is an important on-site use of water in the Canadian Great Lakes Basin. The Ontario Recreation Survey shows that 38% of the people in Ontario go fishing every year. (Government of Ontario 1974). A survey of resident and nonresident anglers licensed in 1970 reported that the sport fishing annual catch amounted to 30 million fish with a weight of approximately 35 million pounds (Cox and Straight 1975).

Commercial fishing in the Great Lakes produces the largest quantity of freshwater fish in Canada with the harvest averaging 40 million pounds a year.

Land Use

Before European settlement, the watershed of the Great Lakes was covered with forest, and even today forest is the dominant land use in the basin. In 1972, 75 percent of the land area in the Canadian Great Lakes Basin was forest (Table 15). Agriculture is the next largest use in terms of area, covering 22 percent of the basin. Urban areas, where the majority of basin residents live and where nearly all of the manufacturing activity takes place, occupy only 1.4 percent of the land area.

TABLE 15

Canadian Great Lakes Basin Land Use, 1972
(ha)

Use	Lake Superior	Lake Huron	Lake Erie	Lake Ontario	Total Basin
Urban Areas Greater than 25,000					
Commercial-Industrial					
Low Density	43	296	1,300	174	1,813
Med. Density	305	290	3,242	3,821	7,658
High Density	1,902	3,112	12,704	36,506	54,224
Total Comm-Ind.	2,250	3,698	17,246	40,501	63,695
Residential					
Low Density	679	2,062	6,997	7,971	17,709
Med. Density	2,836	6,214	20,601	38,242	67,893
High Density	663	1,447	7,717	34,416	44,243
Total Residential	4,178	9,723	35,315	80,629	129,845
Transportation	594	368	1,774	9,511	12,247
Total Urban Greater than 25,000	7,022	13,789	54,335	130,641	205,787
Urban Areas less than 25,000	1,781	69,501	30,611	29,543	131,436
Total Urban Areas	8,803	83,290	84,946	160,184	337,223
Extractive					
Extractive	654	5,143	4,264	6,082	16,143
Slag Heaps	189	485		325	999
Total Extractive	843	5,628	4,264	6,407	17,142
Outdoor Recreation	22,911	166,245	8,029	30,982	228,167
Agriculture					
Orchards, Hort.	814	8,670	18,987	31,520	59,991
Cropland	1,427	503,279	1,163,241	356,209	2,024,156
Imp. Pasture	42,776	1,038,756	502,173	757,323	2,341,028
Unimp. Pasture	8,378	265,177	167,858	299,145	740,558
Total Agriculture	53,395	1,815,882	1,852,259	1,444,197	5,165,733
Forest	9,342,571	6,444,059	342,187	1,254,625	17,383,442
Marsh and Swamp	19,003	58,571	23,438	48,679	149,691
Barren	11,222	19,103	2,884	5,170	38,379
Total Land	9,458,748	8,592,778	2,318,007	2,950,244	23,319,777

Acres = Hectares (ha) x 2.471

Source: PLUARG, 1977.

1 Sq Km = 100 ha.

Air Use

Table 16 contains a summary of the emissions of five common air contaminants in Ontario in 1976, by source. Since 86 percent of the population of Ontario and 92 percent of the Province's economic activity are located in the Great Lakes Basin, it is likely that most of these emissions are generated in the Basin. Industrial processes are the source of 72 percent of the sulphur oxides and more of the particulate matter than any other source. Transportation activities, however, contribute 55 percent of the nitrogen oxides, 43 percent of the hydrocarbons, and 61 percent of the carbon monoxide.

TABLE 16

Emissions of Air Contaminants, Ontario, 1976

Source	Emissions (tonnes)				
	Particulate Matter	Sulphur Oxides	Nitrogen Oxides	Hydro Carbons	Carbon Monoxide
Industrial Processes	217,043	1,668,342	5,032	20,823	276,848
Fuel Combustion Stationary Sources	39,285	629,272	199,635	34,066	66,340
Transportation	22,731	21,695	303,261	341,180	2,851,570
Solid Waste Incineration	5,192	1,519	1,300	2,315	29,450
Miscellaneous	192,028	-	42,598	401,017	1,484,449
Total	476,279	2,320,828	551,826	799,401	4,708,657

Source: A Nationwide Inventory of Emissions of Air Contaminants (1976). 1981. Pollution Data Analysis Division, Air Pollution Programs Branch, Air Pollution Control Directorate, Environmental Protection Service, Environment Canada Report EPS-3-AP-80-1. Ottawa.

Table 17 contains information on the electric energy sold in the Canadian Great Lakes Basin over the period 1961-1976. The actual amount of electricity sold increased by a factor of 2.6 over the 15 year period, while the per capita amount nearly doubled.

Figure 7 shows the trend in gasoline and diesel fuel sold in Ontario and consumed on public roads and highways from 1939 to 1971. Gasoline use especially increased dramatically over that time period. More recently (1980-1982) gasoline use has declined.

TABLE 17

Electric Energy sold in the Canadian Portion
of the Great Lakes Basin 1961-1976

Year	Electric Energy Millions of kwh	Electric Energy kwh per person
1961	26,676.0	5124
1966	39,187.5	6718
1971	55,124.3	8472
1976	69,958.8	9992

Source: Ontario Hydro Statistics Canada

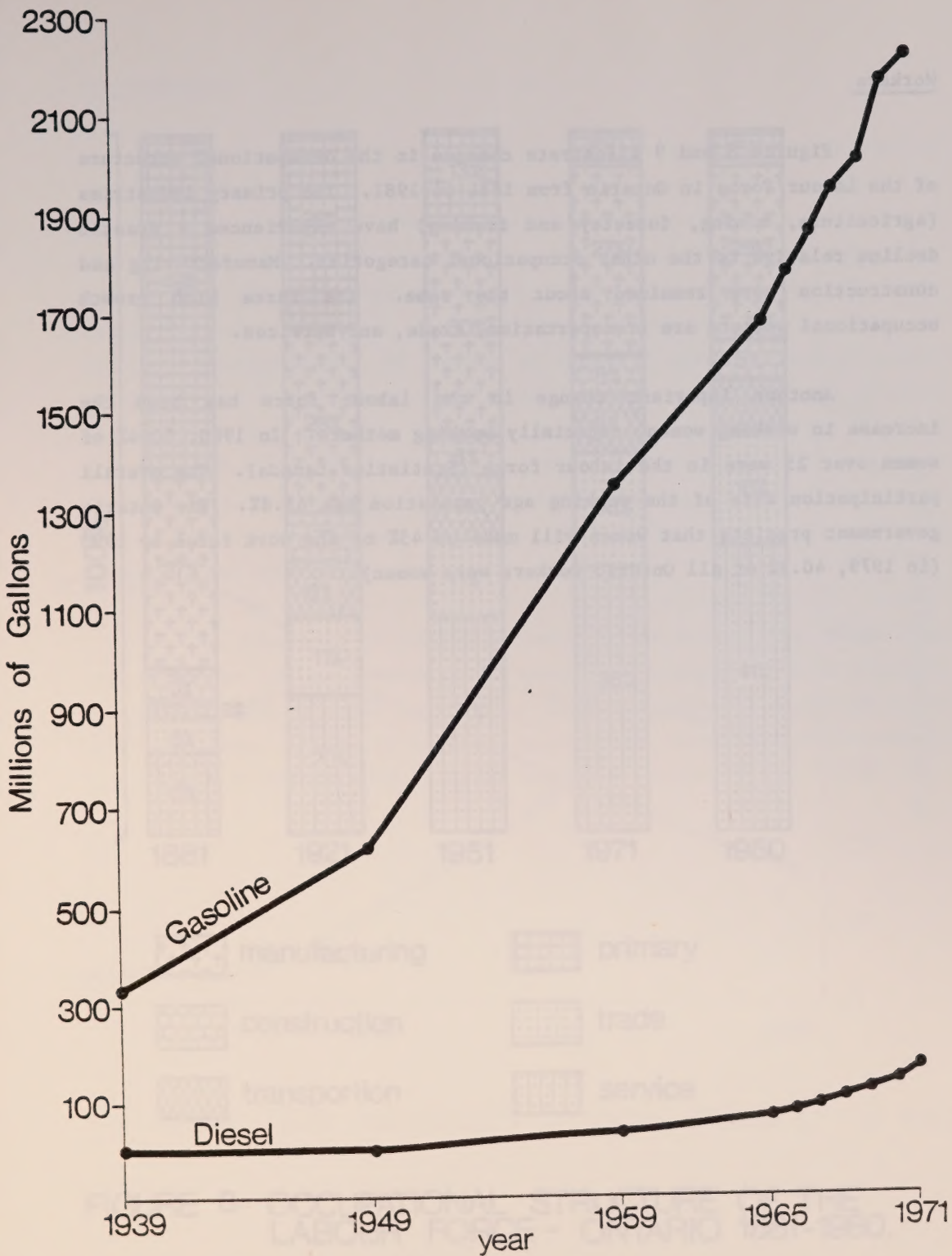


FIGURE 7 GASOLINE AND DIESEL SOLD IN ONTARIO AND CONSUMED ON PUBLIC ROADS AND HIGHWAYS.

Source: Statistics Canada, Motive Fuel Sales 1971, Catalogue No.53 -218

Workers

Figures 8 and 9 illustrate changes in the occupational structure of the Labour Force in Ontario from 1881 to 1981. The primary industries (agriculture, mining, forestry and fishing) have experienced a drastic decline relative to the other occupational categories. Manufacturing and construction have remained about the same. The three high growth occupational sectors are transportation, trade, and services.

Another important change in the labour force has been the increase in working women, especially working mothers. In 1980, 50.4% of women over 25 were in the labour force (Statistics Canada). The overall participation rate of the working age population was 66.8%. The Ontario government predicts that women will make up 45% of the work force by 1990 (in 1979, 40.9% of all Ontario workers were women).

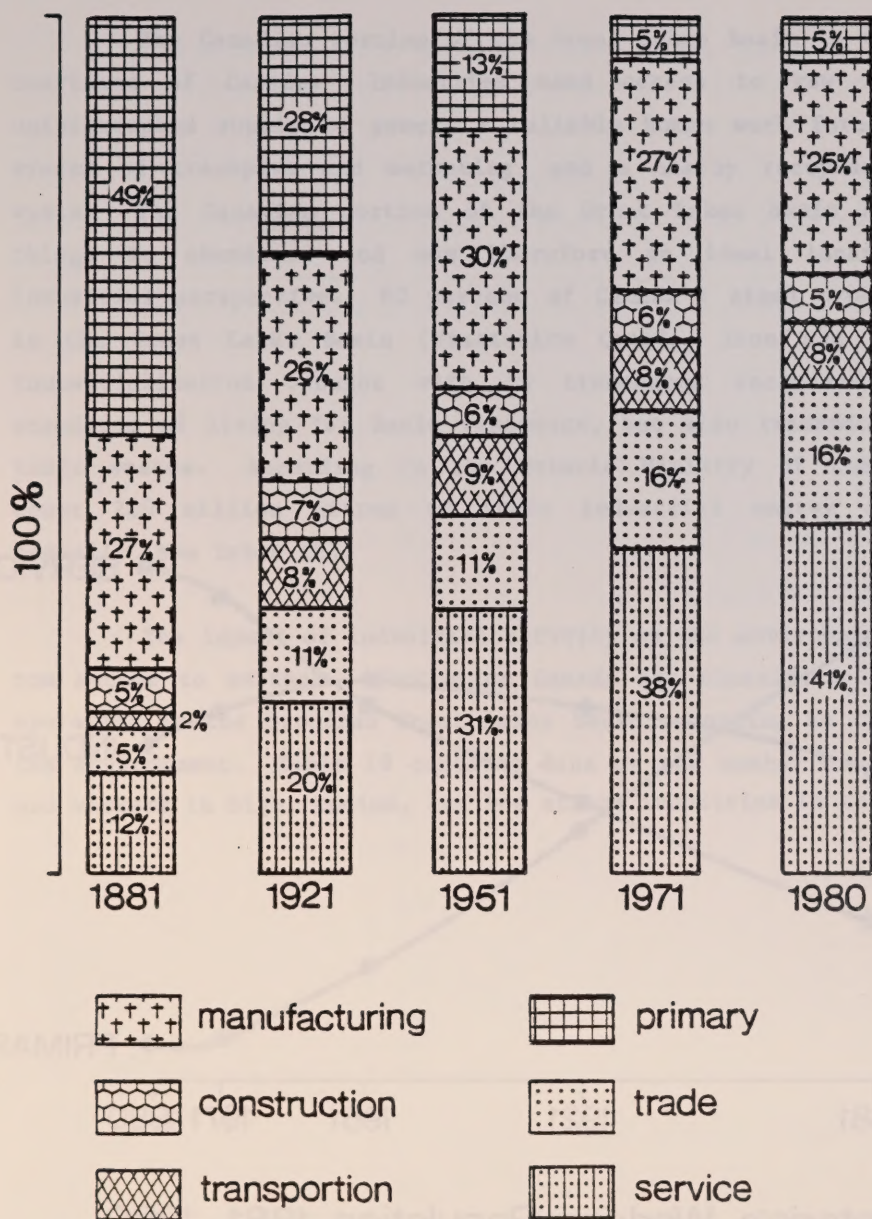


FIGURE 8. OCCUPATIONAL STRUCTURE OF THE LABOUR FORCE - ONTARIO 1881-1980.

source: Statistics Canada.

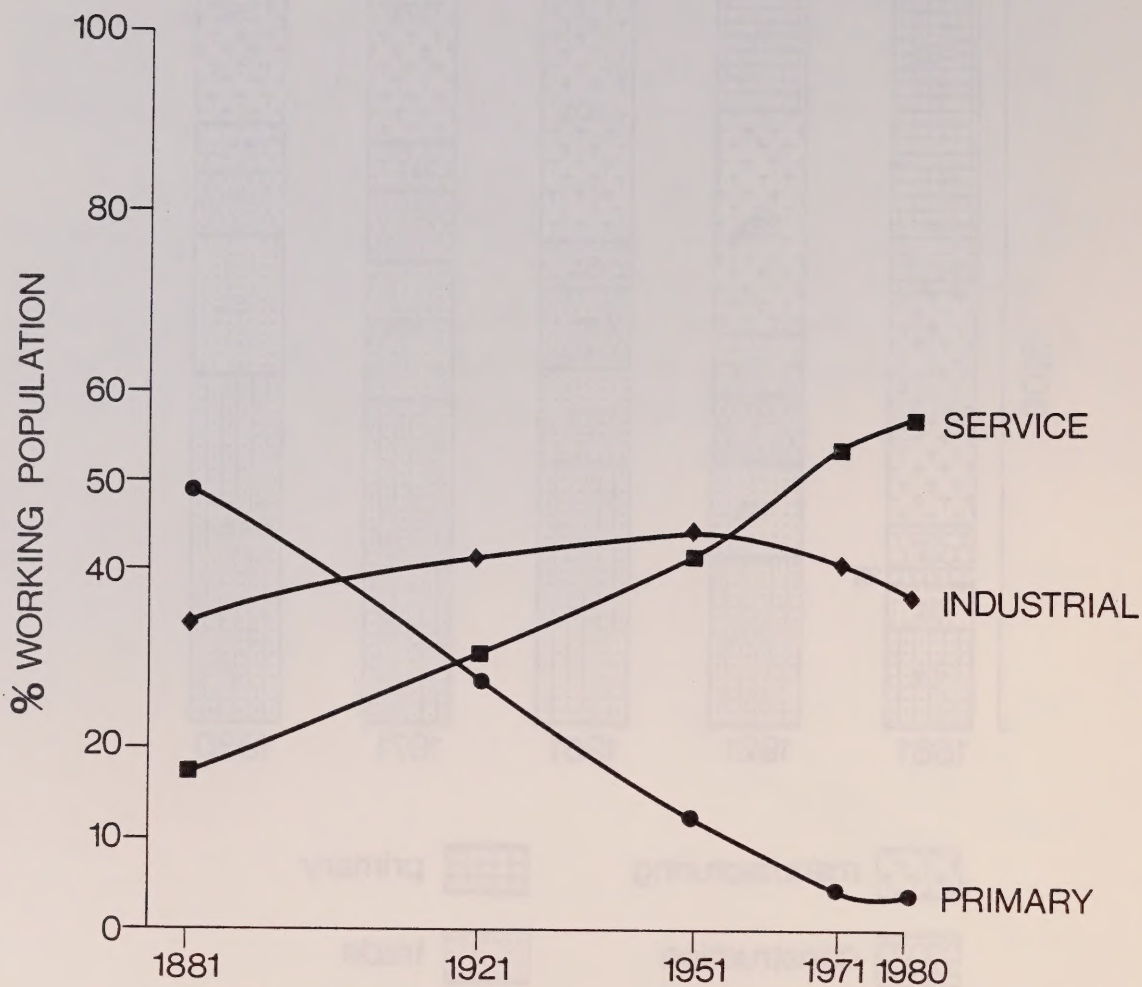


Figure 9 Ontario's Working Population 1881-1980

Manufacturing

The Canadian portion of the Great Lakes Basin is the industrial heartland of Canada. Industries need access to raw materials, an uninterrupted supply of power, a reliable human work force, an assured system of transport and marketing, and a nearby receptacle for their waste. The Canadian portion of the Great Lakes Basin had all these things in abundance and was therefore an ideal location from an industrial perspective. 80 percent of Canada's steel production occurs in the Great Lakes Basin (Statistics Canada, Iron and Steel Mills). Industrialization brought with it tremendous increases in material standards of living for Basin residents, but also tremendous amounts of toxic wastes. According to the Ontario Ministry of the Environment, about 280 million litres of toxic industrial wastes are generated annually (see Table 18).

The impact of industrial activity on the environment varies from one sector to another. Statistics Canada has classified the industries operating in the Canadian Great Lakes Basin according to their stress on the environment. Table 19 contains data on the number of establishments and workers in high, medium, and low stress industries in the basin.

TABLE 18

Emissions and Discharges

Hauled Industrial Waste, Liquids and Sludges, Quantities
Generated by Category, Ontario 1978 and 1980

	1978	1980
'000's litres		
Inorganic Wastes		
Acids	15,355.6	19,250.4
Alkalis	23,389.5	8,630.4
Metal Finishing Wastes	4,230.0	9,249.9
Cyanides	211.4	144.1
Chemical Fertilizer Wastes	-	2,594.8
Phosphates	421.4	1,358.4
Other Inorganics	-	29,475.1
Total	43,607.9	70,703.1
Organic Wastes		
Oily Water	101,660.5	71,467.1
Waste Oils	16,794.8	11,857.2
Organic Solvents	14,526.9	13,862.8
Chlorinated Solvenes	-	611.9
Plastic Resins	9,618.7	6,743.1
Amines	1,320.2	1,413.7
Glycols	1,017.8	2,135.2
Phenols	29,443.1	2,291.3
PCB's	175.9	705.9
Other	161.0	16,932.9
Total	174,788.9	128,021.1
Organic and Inorganic Product Wastes		
Pigments, Paint, Printing and Adhesives	10,280.1	14,002.0
Pesticides	4,509.5	1,085.6
Detergents, Cleaners and Soaps	-	1,905.2
Pharmaceutical and Cosmetics	83.2	101.1
Plant and Animal Wastes	6,622.5	13,713.8
Inert Sludges	7,149.8	50,913.7
Unspecified	3,565.8	-
Total	32,210.9	81,721.4
TOTAL	250,607.4	280,445.6

SOURCE: Ontario Ministry of the Environment

TABLE 19

Industrial Activity "Stressor Type", Great Lakes Basin, 1973

	ESTABLISHMENTS		WORKERS	
	Number	Percent	Number	Percent
Lake Superior				
High	11	10	4,729	64
Medium	22	19	246	3
Low	80	71	2,484	33
Lake Huron				
High	45	4	18,498	37
Medium	248	23	7,687	15
Low	765	73	23,813	48
Lake Erie				
High	51	2	2,693	2
Medium	594	24	33,399	22
Low	1,859	74	114,939	76
Lake Ontario				
High	107	1	34,405	9
Medium	1,392	18	66,084	18
Low	6,181	81	262,960	73
Great Lakes				
High	214	2	60,325	11
Medium	2,256	20	107,416	19
Low	8,885	78	404,196	70
TOTAL	11,355		571,937	

SOURCE: Statistics Canada, Human Activity and the Environment.

Agriculture

The Great Lakes Basin has the best soils and warmest climate for agriculture in Canada. Rapid growth in agricultural productivity has resulted in the release of labour and land to other sectors of the economy while permitting absolute growth in the volume of agricultural commodities produced. These changes have been achieved through intensified use of intermediate inputs, especially machinery, fertilizers, and pesticides.

Between 1931 and 1976, the farm population of the Great Lakes Basin declined both relatively and absolutely (see Table 20).

Employment, as well as population, has declined in the agricultural sector. In absolute terms, Ontario's agricultural labour force declined from 153,000 in 1965 to 119,000 in 1976 (see Table 21). Agriculture's share of the Ontario labour force declined steadily over this period, from 5.9 percent to 3 percent.

During the postwar period, the productivity as measured by output per man-hour, of Canadian Agriculture has grown at a rate one-third faster than productivity in manufacturing (see Table 22).

TABLE 20

Decline in Great Lakes Basin Farm Population

Year	Farm Population	% of Total Population
1931	672,406	23.3
1941	591,361	18.6
1951	589,982	15.3
1956	573,503	12.6
1961	440,309	8.4
1966	418,092	7.2
1971	329,038	5.1
1976	286,534	4.1

Sources: 1971 Census of Canada, Vol. IV, Part 2

1976 Census of Canada,

TABLE 21

Agriculture's Declining Share of the Labour Force in Ontario

Year	Total Ontario Labour Force ('000)	Agricultural ('000)	Labour Force % of Total
1965	2614	153	5.9
1966	2719	142	5.2
1967	2834	149	5.3
1968	2934	146	5.0
1969	3032	139	4.6
1970	3130	135	4.3
1971	3249	138	4.2
1972	3381	120	3.5
1973	3509	124	3.5
1974	3671	123	3.4
1975	3857	124	3.2
1976	3931	119	3.0

Source: SC Labour Force Survey Division

TABLE 22

Productivity in Canadian Agriculture and Manufacturing

Year	Output per Man-Hour (1961 = 100.0)	
	Agriculture	Manufacturing
1946	52.2	56.5
1950	63.7	65.3
1955	90.3	80.1
1960	112.9	94.8
1965	153.2	117.9
1970	177.7	142.9

Source: Canada Year Book.

The area utilized by agriculture has declined in step with the agricultural labour force. The area occupied by farms in Ontario fell by over 2.8 million hectares between 1931 and 1976. Seventy five percent of this decline occurred after 1951.

The area of improved farmland, which includes cropland, improved pasture, and other improved areas, continued to expand until 1941. Subsequently, this area declined by nearly one million hectares until 1971 and since then it has increased slightly (see Table 23). Nearly one-half of the decline occurred between 1966 and 1971. Most of this decline occurred in regions of marginal farmland, but some prime farmland was lost to urbanization.

While the total area of farmland has been declining, the area of a 'typical' farm has been increasing (see Table 24). Figure 10 shows the geographic distribution of the changes in number of farms over the period 1951-1966. The number of farms in Ontario was halved between 1921 and 1971. In the same period, the total area per farm increased by nearly 50 percent, while the area of improved farmland per farm increased by nearly 75 percent.

Despite the contraction of the land and labour resources used by agriculture, the volume of commodities marketed has continually grown. Table 25 presents the index of the physical volume of agricultural production for Ontario. Physical output grew by 76 percent between 1951 and 1976, an annual growth rate of 3.0 percent. For census years, it is possible to relate the physical volume of output to the area of improved farmland. Table 25 also shows a measure of the overall yield of improved Ontario farmland. Between 1951 and 1976 it grew by 102 percent, an annual growth rate of 4.1 percent. This apparent increase in productivity was caused by the abandonment of less fertile soils as well as by technological change and increased use of inputs.

TABLE 23

Change in the Area of Ontario Farmland

Year	Area of Farms (Hectares)	Area of Improved Farmland (Hectares)
1921	9,051,560	5,267,743
1931	9,136,359	5,309,194
1941	8,955,192	5,345,344
1951	8,352,021	5,077,300
1961	7,431,402	4,813,169
1966	7,130,418	4,801,722
1971	6,385,222	4,345,840
1976	6,189,204	4,427,737

Sources: 1971 Census of Canada Cat. 96-707
1976 Census of Canada

TABLE 24

Increasing Farm Size in Ontario

Year	Average Farm Size (Hectares)	Area of Improved Farmland Per Farm (Hectares)
1921	45.7	26.6
1931	47.6	27.6
1941	50.2	30.0
1951	55.7	33.9
1961	61.2	39.7
1971	67.4	45.9
1976	69.7	49.9

Source: Statistics Canada, Censuses of Agriculture.

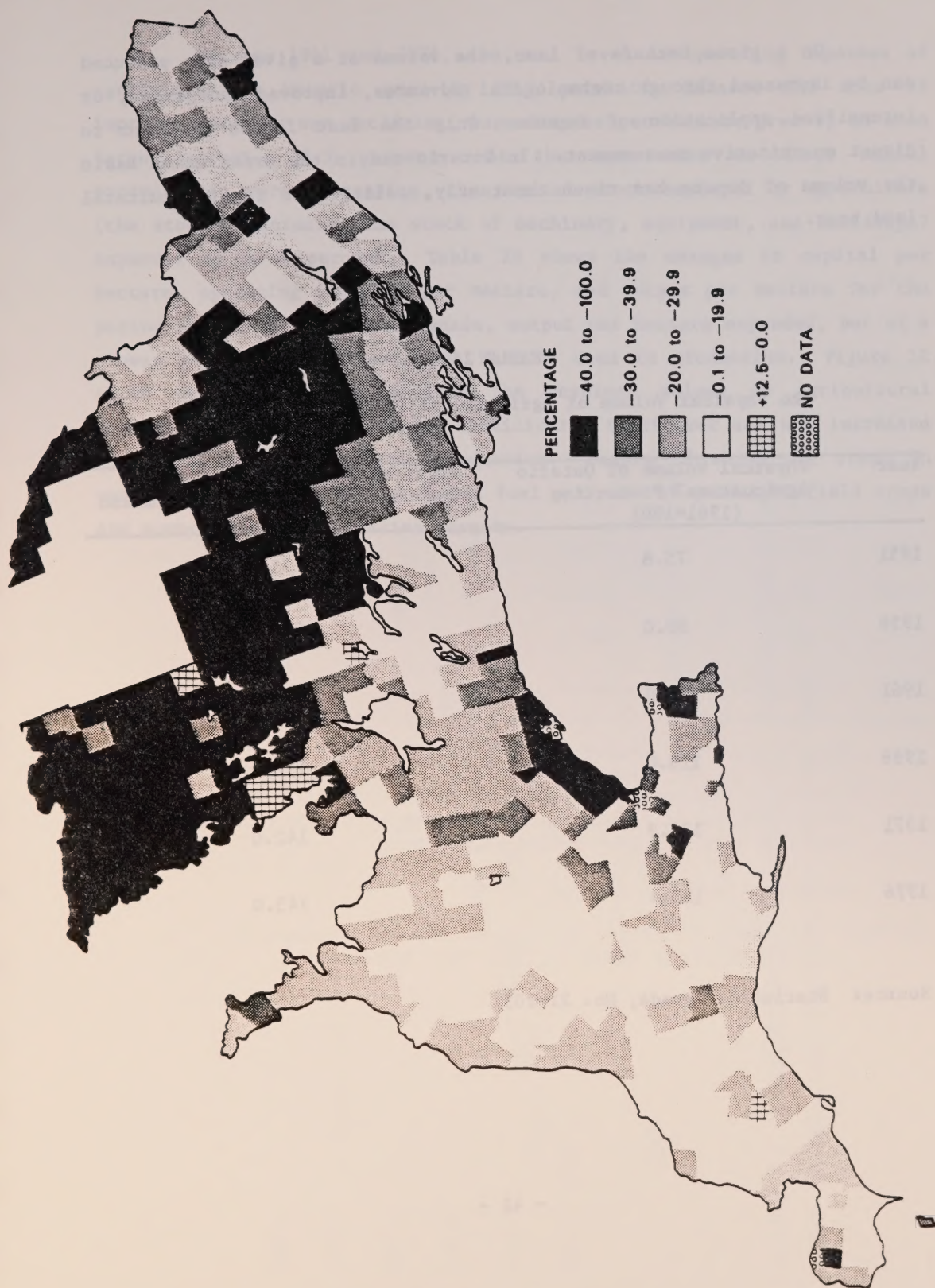


FIGURE 10 PERCENT CHANGE IN NUMBER OF FARMS 1951 - 1966
SOURCE: 1966 CENSUS OF AGRICULTURE

On a given hectare of land, the volume of a given crop produced can be increased through technological advances, improved management, or intensified application of inputs. Only the last factor is open to direct quantitative measurement. In Ontario and in the Great Lakes Basin the volume of inputs has risen constantly, relative to the agricultural land base.

TABLE 25

The Physical Volume of Agricultural Production 1951-1976

Year	Physical Volume of Ontario Agricultural Production (1961=100)	Physical Volume of Production Per Hectare of Improved Farmland (1961=100)
1951	75.8	71.8
1956	80.0	76.6
1961	100.0	100.0
1966	118.0	118.2
1971	127.9	142.0
1976	133.4	145.0

Source: Statistics Canada, No. 21-203.

Between 1961 and 1971, the real level of operating expenses of agriculture in Ontario grew by 28.1 percent. Because the area of improved farmland was declining, expenditures per hectare grew by an even larger amount, 41.9 percent. At the same time as these annual expenditures were increasing, the capital stock employed by agriculture (the stock of animals, the stock of machinery, equipment, and buildings) expanded by 52.6 percent. Table 26 shows the changes in capital per hectare, operating expenses per hectare, and output per hectare for the period 1961-1971. Over the decade, output per hectare expanded, but at a slower rate than did inputs per hectare used in production. Figure 11 shows the relationship between the physical volume of agricultural production and a single input, fertilizer. Fertilizer use has increased at a much faster rate than production. Figure 12 shows the trend in consumption of gasoline and diesel fuel per acre of principal field crops and summer fallow by Canadian farmers.

TABLE 26

Productivity Gains and Their Cost

Year	OutPut/Acre	Capital/Acre** (1961 = 100)	Operating Expenses Per Acre***
1961	100.0	100.0	100.0
1962	105.1	107.3	97.8
1963	106.4	109.1	104.1
1964	108.3	112.7	109.9
1965	108.7	115.2	113.7
1966	118.2	117.5	117.7
1967	117.2	124.5	125.5
1968	123.6	131.0	127.5
1969	125.2	142.4	128.4
1970	135.2	147.3	135.7
1971	139.6	152.6	141.9

** Constructed from Livestock population figures and from nominal estimates of the value of the capital stock in machinery and equipment, published by Statistics Canada. Net nominal investment was inferred from annual changes in the stock and converted into constant dollar magnitudes.

*** Statistics Canada 21-202 and 62-004.

Source: Deutscher, P. 1976. The Path of Ontario Agriculture, Social Sciences Division, IWD, Ont. Burlington.

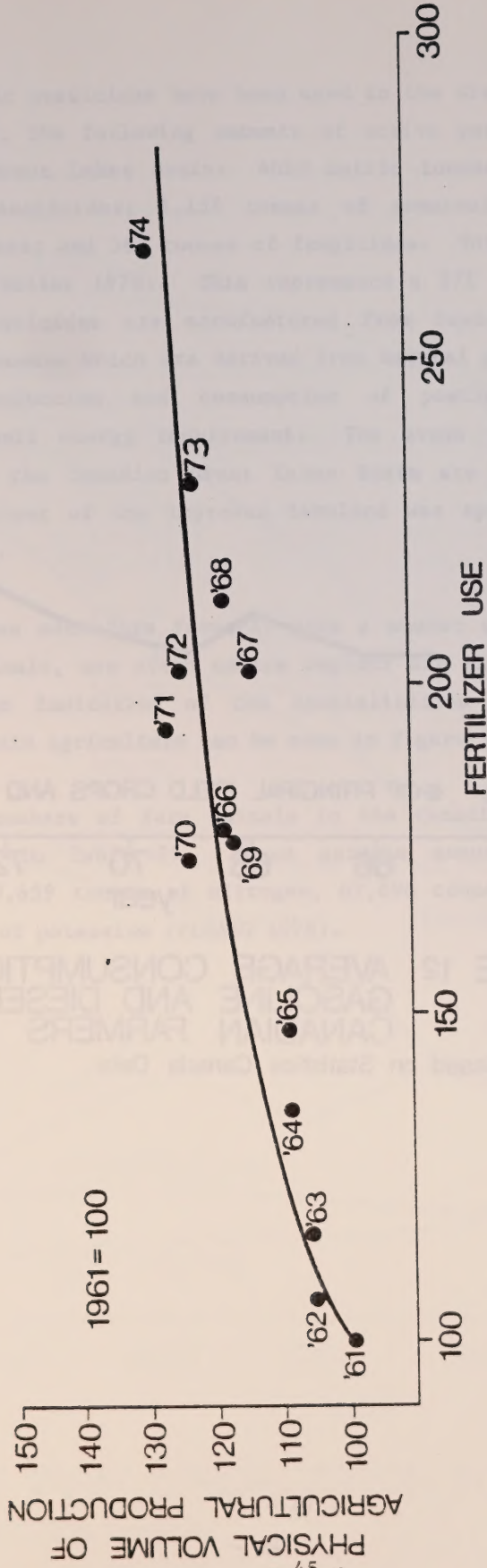


FIGURE 11 DIMINISHING RETURNS OF FERTILIZER USE IN ONTARIO

SOURCE : SC CATALOGUE NO. 21-203 AND FERTILIZER TRADE.

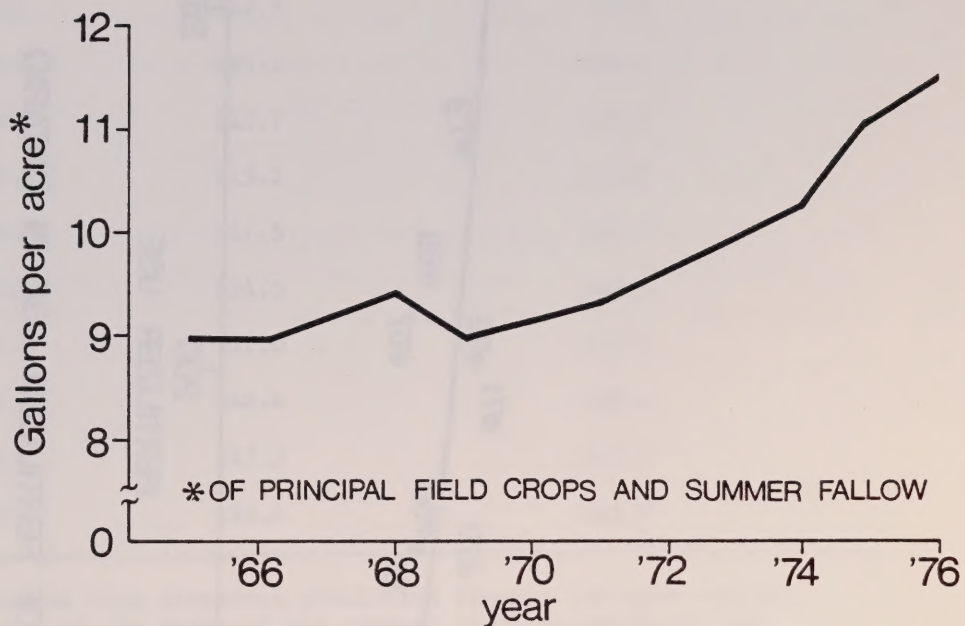


FIGURE 12 AVERAGE CONSUMPTION RATES OF
GASOLINE AND DIESEL FUEL BY
CANADIAN FARMERS

Source : Based on Statistics Canada Data.

Organic pesticides have been used in the Great Lakes Basin since 1945. In 1978, the following amounts of active pesticide were used in the Canadian Great Lakes Basin: 4010 metric tonnes of herbicides; 413 tonnes of insecticides; 1,157 tonnes of nematocides; 403 tonnes of growth regulators; and 367 tonnes of fungicides. Total pesticide use was 6,350 tonnes (Roller 1978). This represents a 57% increase since 1973. Since most pesticides are manufactured from basic chemicals such as ethylene and benzene which are derived from natural gas or crude oil, the growth in production and consumption of pesticides represents an increasing fossil energy requirement. The areas of land sprayed and fertilized in the Canadian Great Lakes Basin are listed in Table 27. Forty-five percent of the improved farmland was sprayed and 66 percent was fertilized.

Whereas each farm formerly grew a number of crops along with a variety of animals, now often entire regions are planted in only one or two crops. An indication of the specialization and concentration in Great Lakes Basin agriculture can be seen in Figure 13 and Table 28.

The numbers of farm animals in the Canadian Great Lakes Basin are presented in Table 29. These animals annually generate manure containing 139,659 tonnes of nitrogen, 67,696 tonnes of phosphorus, and 77,151 tonnes of potassium (PLUARG 1978).



FIGURE 13. FARM SPECIALIZATION IN ONTARIO 1951-1978

TABLE 27

Farms and Farmlands Fertilized, Sprayed, and
Irrigated, Great Lakes Basin, 1971

(HECTARES)

	Lake Superior	Lake Huron	Lake Erie	Lake Ontario	Great Lakes Basin
Watershed Area	7,928,827	9,356,449	2,404,962	3,141,940	22,832,173
Total Farmland	44,404	1,884,011	1,790,915	1,243,842	4,963,172
Cropland	13,800	834,260	1,237,740	551,173	2,636,973
Other Improved Farmland	1,424	46,283	54,693	37,398	139,798
Area Fertilized	6,032	476,878	1,017,464	327,915	1,828,289
Area Sprayed For Weeds	458	282,440	583,642	149,485	1,016,025
Area Sprayed For Insects	222	45,908	132,865	40,685	219,680
Area Irrigated	48	4,162	28,026	5,488	37,724
Number of Farms	461	24,937	32,544	21,012	78,954

Source: Human Activity and the Environment

Statistics Canada

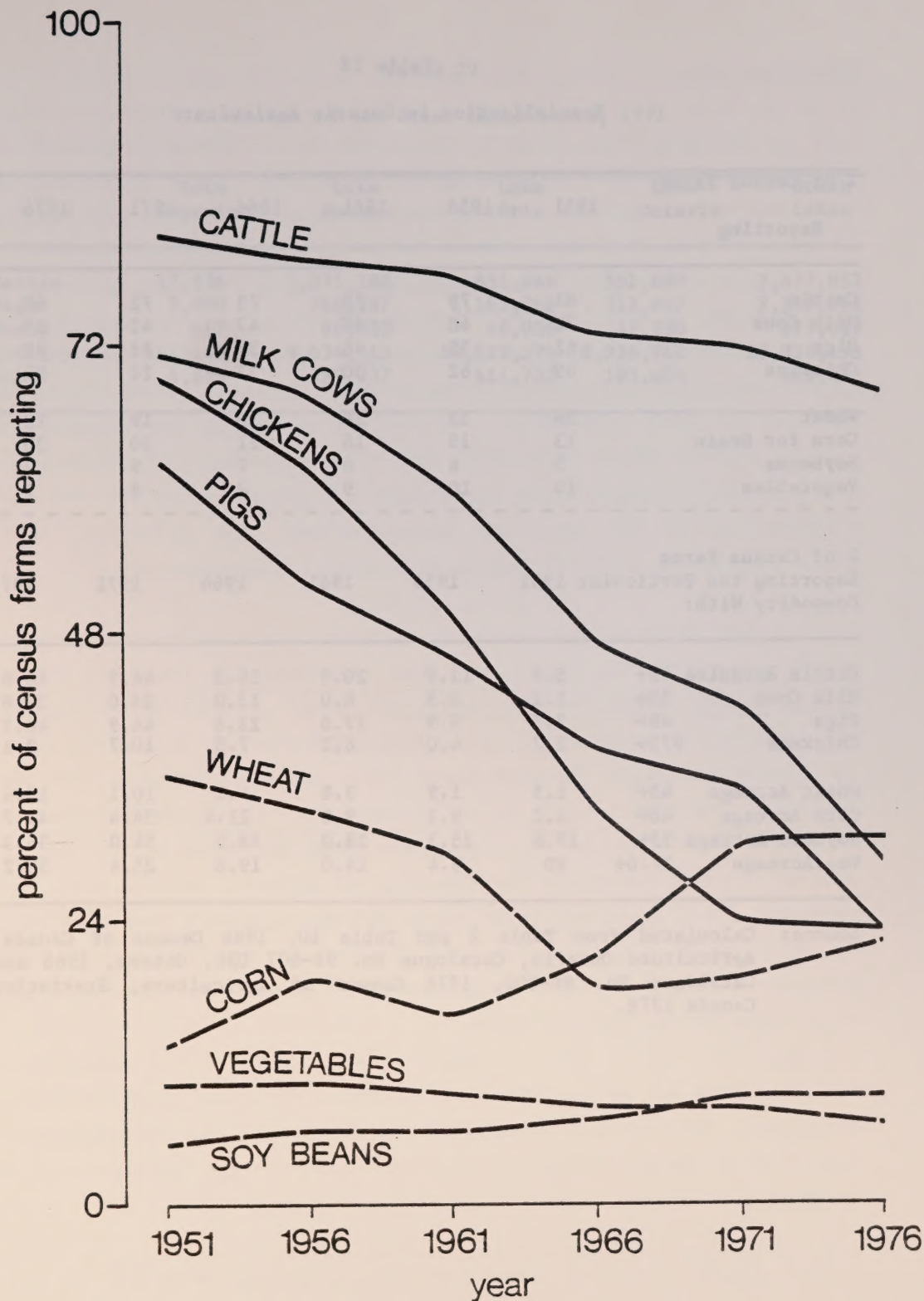


FIGURE 13 FARM SPECIALIZATION IN ONTARIO 1951-1976

SOURCE : STATISTICS CANADA

Table 28

Specialization in Ontario Agriculture

% of Census Farms Reporting		1951	1956	1961	1966	1971	1976
Cattle		81	79	78	73	72	68
Milk Cows		71	68	60	47	42	29
Pigs		62	52	46	38	35	23
Chickens		69	62	50	33	24	23
Wheat		36	33	29	18	19	22
Corn for Grain		13	19	16	21	30	30
Soybeans		5	6	6	7	9	9
Vegetables		10	10	9	8	8	7

% of Census Farms Reporting the Particular Commodity With:		1951	1956	1961	1966	1971	1976
Cattle Herdsize	48+	5.5	11.9	20.5	29.3	44.9	46.6
Milk Cows	33+	1.1	2.5	6.0	13.0	25.0	38.8
Pigs	48+	7.5	9.9	17.8	23.6	44.9	46.3
Chickens	973+	2.7	4.0	6.2	7.5	10.7	9.1
Wheat Acreage	48+	1.5	1.9	3.8	4.1	10.1	18.6
Corn Acreage	48+	4.1	8.1	9.0	21.4	34.4	41.7
Soybean Acreage	33+	19.8	25.3	28.0	38.6	54.0	56.3
Veg.Acreage	17.6+	ND	9.4	14.0	19.8	25.4	35.2

Source: Calculated from Table 2 and Table 10, 1966 Census of Canada, Agriculture Ontario, Catalogue No. 96-607 DBS, Ottawa, 1968 and Catalogue No. 96-806, 1976 Census of Agriculture, Statistics Canada 1978.

Table 29

Livestock in the Great Lakes Basin, 1971

	Lake Superior	Lake Huron	Lake Erie	Lake Ontario	Great Lakes
Cattle	12,536	1,071,180	831,644	561,697	2,477,057
Pigs	2,980	766,397	1,163,768	313,947	2,247,092
Sheep	417	80,983	48,036	47,590	177,026
Poultry	141,145	9,034,515	10,923,571	8,936,962	29,036,193
Other	4,659	199,937	411,722	185,804	802,122

Transportation

Transportation of goods and people is an intergral part of the urban lifestyle of the Canadian Great Lakes Basin. People live in one place and work in another, often many kilometres away. Basic necessities of life, such as food, are produced in one place and consumed in another, requiring a massive distribution network. The overwhelming majority of this movement of goods and people is accomplished by internal combustion engines. Therefore, the full impact of transportation activities on the environment goes well beyond those directly resulting from the actual movement of goods and people. A complete review of the impacts must include all of those associated with the extraction, production, and distribution of fossil fuels as well as the production of the vehicles, construction of the necessary infrastructure, air pollution, water pollution, noise, potential spills of hazardous substances, etc.

All forms of transportation represent about one-quarter of total energy consumption in Canada, and road transportation (cars and trucks) accounts for approximately 80% of total transportation energy requirements (Furniss, 1978). According to Statistics Canada the number of automobiles in the Canadian Great Lakes Basin increased by 56% from 1967-1976. Currently there are 2.5 million cars in the basin, about one for every three people. In urban areas about one-third of the land is devoted to the automobile in the form of streets, parking lots, and garages. Paved roads and highways in Ontario increased from 4008 miles in 1935 to 26,453 miles in 1973 (Statistics Canada 53-201). This increase in length has been compounded by an increase in width with most major highways now having 4 lanes.

There are no statistics on the number of miles travelled by cars and trucks, but relative changes in the amounts of gasoline and diesel fuel sold in Ontario (Figure 7, Page 29), give a rough indication of the increasing extent of these forms of transportation.

Air transportation is becoming more popular among Great Lakes Basin residents, especially businessmen who routinely jet back and forth to meetings. In 1975, over 10.5 million passengers landed at the four major airports in the Canadian Great Lakes Basin - Toronto, Thunder Bay, Windsor, and London (SC Catalogue 51-203).

The Great Lakes themselves are vital for water-borne transportation. The major commodities shipped are iron ore, coal and grain. Statistics on Great Lakes-St. Lawrence Seaway traffic are shown in Table 30. In 1980 the total cargo passing through the Welland Canal was 59.6 million tonnes.

TABLE 30

Great Lakes-St. Lawrence Seaway Cargo Traffic 1979-1980
(million tonnes)

Commodity	Montreal to Lake Ontario Section		Welland Canal Section	
	1979	1980	1979	1980
Grain	24.7	26.7	26.2	28.1
Iron Ore	14.8	11.0	15.1	11.4
Coal	0.5	0.2	7.8	7.3
Other Bulk	11.6	9.1	13.9	11.2
General Cargo	3.7	2.5	3.3	1.6
Total	55.3	49.5	66.3	59.6

Source: Economics Section, St. Lawrence Seaway Authority, January 1981.

Forestry

Forest is the natural climax vegetation of the Canadian Great Lakes Basin. In the southern part of the basin most of the virgin forest was cleared a century ago for agriculture, but there are still over 17 million hectares of forested land in the basin (see Table 15 page 26). In fact, more land is in forests than any other use (75 percent).

Forests are much more than trees. They are diverse biological communities of plants and animals, soils, and water. Forests perform several important environment functions in addition to providing timber and fuel wood. They provide habitat for wildlife, regulate water cycles, protect land from soil erosion, and also convert carbon dioxide to oxygen through plant respiration.

Forests yield economic support for independent wood cutters and mill operators, huge pulp and paper giants, and urban and rural dwellers alike. In 1980, 78,600 people were employed in the forest industry in Ontario (Statistics Canada). Pulp and paper is currently the most valuable product of the forests, as measured in dollar value. Trends in the volume of paper produced in Ontario are shown in Table 31. The amount of paper has doubled over the 1950-1974 period. Table 32 contains information on the amounts of timber harvested from Ontario forests for various human purposes.

Forests are also used for recreation by campers, hunters, hikers and others. It has been estimated that one-third of the tourism industry is directly or indirectly concerned with the forest landscape (Carlisle A. and Maini, J.S. 1974). Most recreational uses of forests do not harm the resource, but additional population pressure does increase the incidence of human caused forest fires.

Most of the forestry harvesting operations in Canada are clear cutting (83 percent). In clear cutting, all of the trees are removed from an area at once and this can have adverse impacts on wildlife, soils and water quality. Only 5 percent of the annual depleted acreage in Canada is

replanted (Chapman, J.D. 1976). And even when areas are reforested, the result is uniform stands of one type of tree rather than the natural diversity which was there before.

TABLE 31

Trends in the Volume of Paper Production, Ontario, 1950-1974

Year	Paper Production Thousands of Tonnes
1950	1731
1955	2023
1960	2318
1965	2563
1970	2889
1974	3411

Source: Statistics Canada, The Pulp and Paper Industry

Table 32

Human Use of Forest Resources, Ontario 1969-1975

(Thousands of Cu.Ft. of Merchantable Timber)

Utilization	1969	1970	1971	1972	1973	1974	1975
Logs and Bolts	176,000	182,000	190,000	215,000	224,500	212,500	186,000
Pulpwood	407,150	375,700	334,500	365,500	393,500	420,000	280,000
Other Round-Wood	7,415	6,875	7,340	7,100	7,200	5,300	5,000
Non-Industrial Wood (fuelwood)	32,080	28,640	27,500	25,500	26,200	28,500	31,000
TOTAL	621,645	593,315	559,340	613,100	651,400	666,300	502,000

Source: Statistics Canada, Canadian Forestry Statistics

References

- Carlisle, A. and Maini, J.S. 1974. Conservation in Canada. Department of the Environment. Canadian forestry Service. Publication No. 1340. Ottawa.
- Chapman, J.D. 1976. Natural Resource Developments in Canada, 1970-75. The Canadian Geographer, Vo. XX, 1.
- Cox, E.T. and W.J. Straight 1975. Ontario angling facts and figures. Ontario Ministry of Natural Resources.
- Furniss, I.F. 1978. The energy demands of agriculture. Canadian Farm Economics. Volume 13, Number 3.
- Government of Ontario 1974. Ontario Recreation Survey. Tourism and Outdoor Recreation Planning Study. Progress Report No. 2.
- International Lake Erie Regulation Study 1981. Appendix D. Commerical Navigation. International Joint Commission.
- International Lake Erie Regulation Study 1981. Appendix E. Power. International Joint Commission.
- PLUARG, 1977. Inventory of land use and land use practices, Canadian Great Lakes Basin summary. International Joint Commission, Windsor.
- PLUARG 1978. Final Report. International Joint Commission, Windsor.
- Roller, Nick F. 1979. Survey of pesticide use in Ontario 1978. Economics Branch. Ontario Ministry of Agriculture and Food. Toronto.
- Sewell, W.R.D., Blair Bower, et al. 1968. Forecasting the demands for water. Policy and Planning Branch. Department of Energy, Mines and Resources, Ottawa.
- Tate, Donald 1979. Consumptive water use in the Canadian section of the Great Lakes Basin 1975-2035. International Great Lakes Diversions and Consumptive Uses Working Committee. Environment Canada, Ottawa.
- Vallentyne, J.R. 1978. Presidential: Today is yesterday's tomorrow. Verh. International Verein. Limnol. 20. 1-12, Stuttgart.
- Vallentyne, J.R. 1978. The ecosystem approach. Scientific Advisory Board. International Joint Commission, Windsor.

